

Current Focus and Future Directions

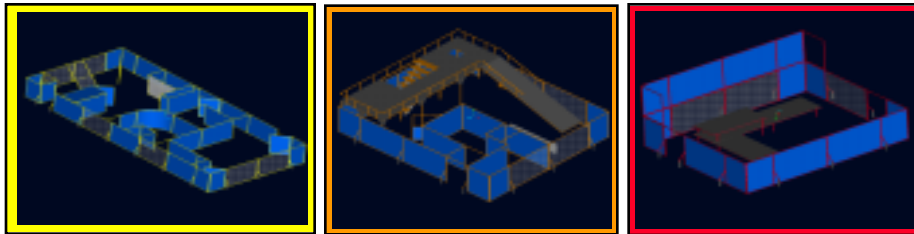
- **Incremental improvements**
 - Instrumentation
 - Targets, structured light, debris
 - More obstacles and hazards
- **Transportable Facility**
 - Conferences and Exhibitions
 - Tours around the world
- **Permanent Facility in U.S.**
 - Administered by NIST
 - Virtual, Indoor, Underground and Outdoor Testing Arenas
- **Leverage from other Autonomous Mobile Robot Domains**
 - Manufacturing Environments
 - Hazardous Waste Environments
 - Military Reconnaissance/Support
 - Planetary Exploration



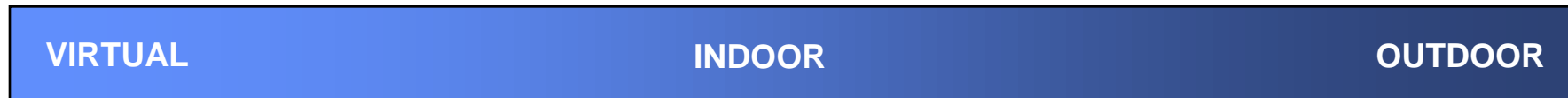
Yellow and Orange Arenas Crated for Shipping

Spectrum of Test Arenas *FOR COMPREHENSIVE PERFORMANCE METRICS*

ACTIVE ARENAS



“USAR”



PROPOSED ARENAS

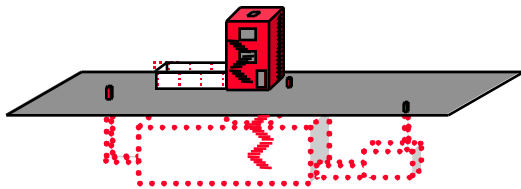
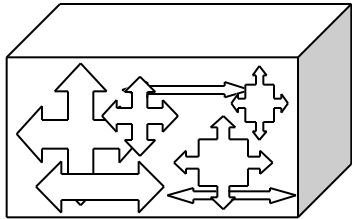
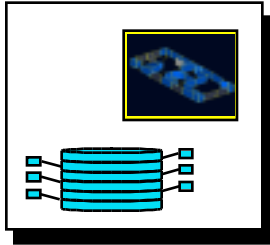


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Spectrum of Test Arenas

PROPOSED ARENAS

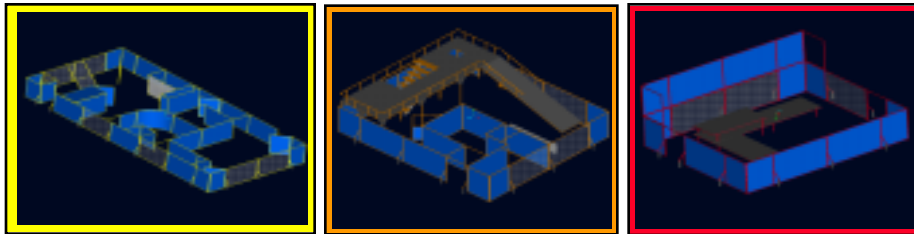


- **Virtual Arena**
 - Captured sensor data with ground truth (and noise)
 - Faster algorithm development (hardware independent)
 - Test successful algorithms in actual arena
- **Confined Space Maneuver Arena**
 - Test shape shifting robotic implementations
 - Evaluate situational awareness, improved access, shoring
 - Environment Negotiation = Navigation + Influence
- **Reality Arena**
 - Realistic, safe, controlled and repeatable
 - Above ground and below ground barrier penetrations
 - Indoor situational awareness, comms dropouts
- **Scout Arena**
 - Equestrian style, sensor based obstacles
 - Test marsupial implementations, transition recognition
 - For lightweight UGVs (< 500 lbs)

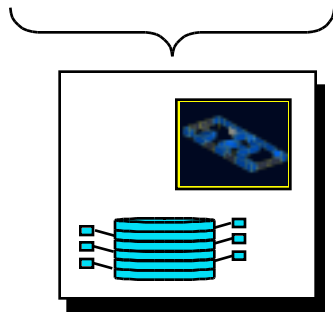
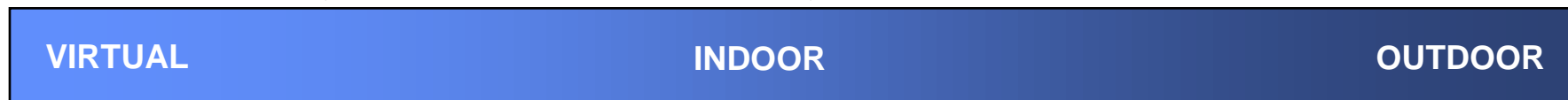
Spectrum of Test Arenas

FOR COMPREHENSIVE PERFORMANCE METRICS

ACTIVE ARENAS



“USAR”



“VIRTUAL”

PROPOSED ARENAS

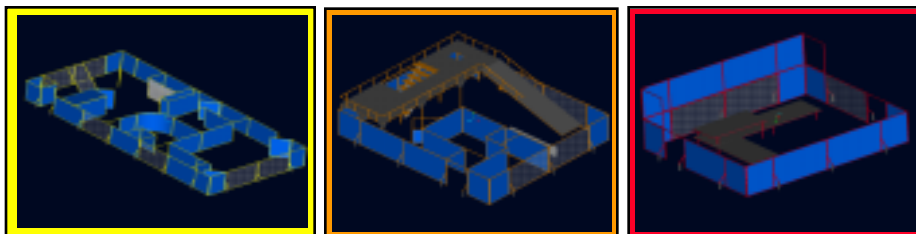


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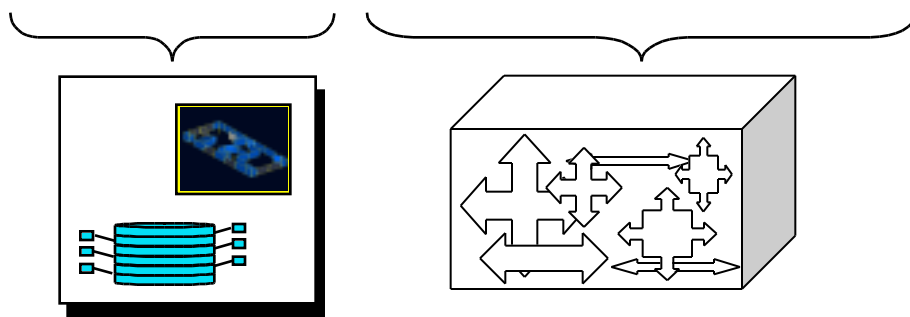
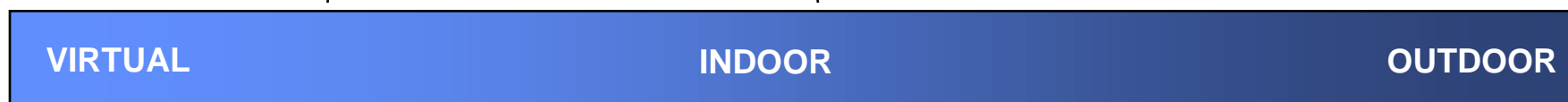


Spectrum of Test Arenas *FOR COMPREHENSIVE PERFORMANCE METRICS*

ACTIVE ARENAS



“USAR”



“VIRTUAL”

**“CONFINED SPACE
MANEUVER”**

PROPOSED ARENAS

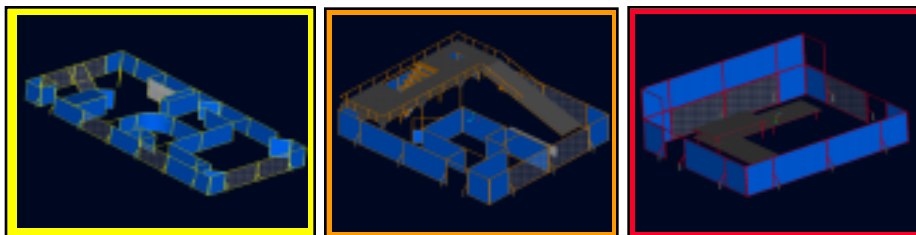


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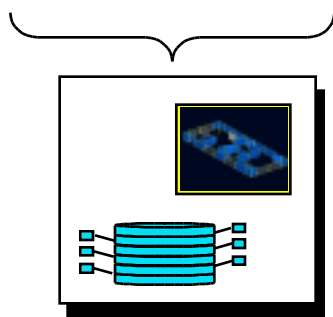
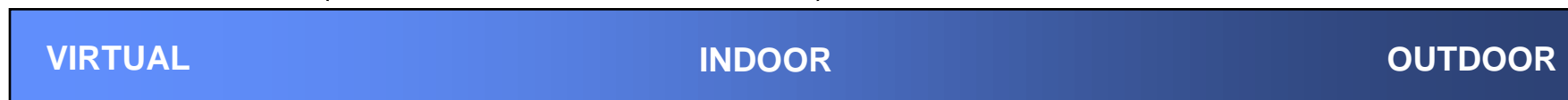


Spectrum of Test Arenas *FOR COMPREHENSIVE PERFORMANCE METRICS*

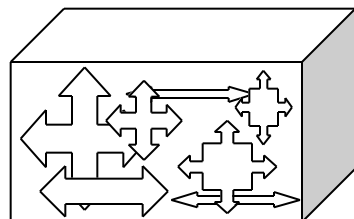
ACTIVE ARENAS



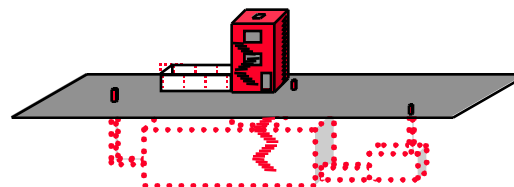
“USAR”



“VIRTUAL”



**“CONFINED SPACE
MANEUVER”**



“REALITY”

PROPOSED ARENAS

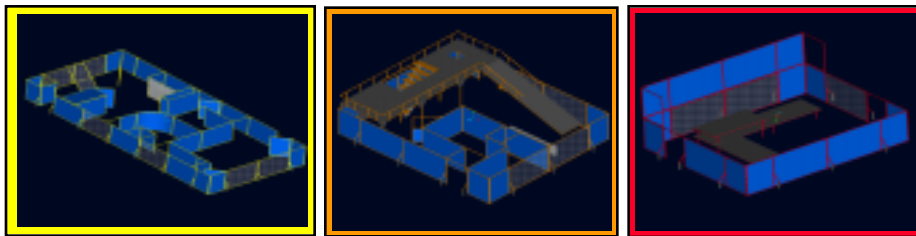


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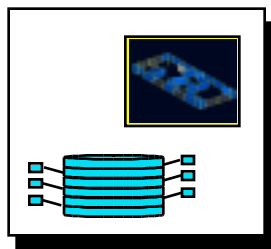
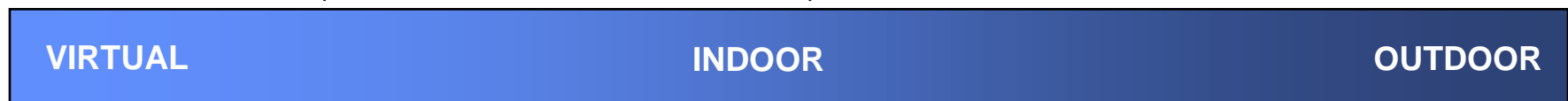


Spectrum of Test Arenas *FOR COMPREHENSIVE PERFORMANCE METRICS*

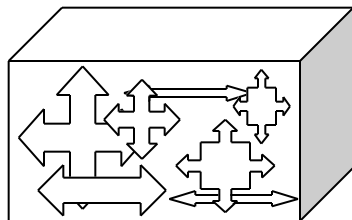
ACTIVE ARENAS



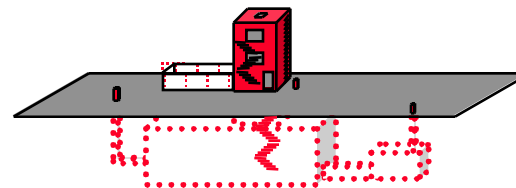
“USAR”



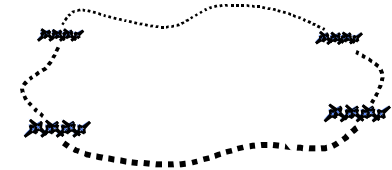
“VIRTUAL”



**“CONFINED SPACE
MANEUVER”**



“REALITY”



“SCOUT”

PROPOSED ARENAS



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Acquired Venue for Test Arenas

CONVERTED MISSILE SITE



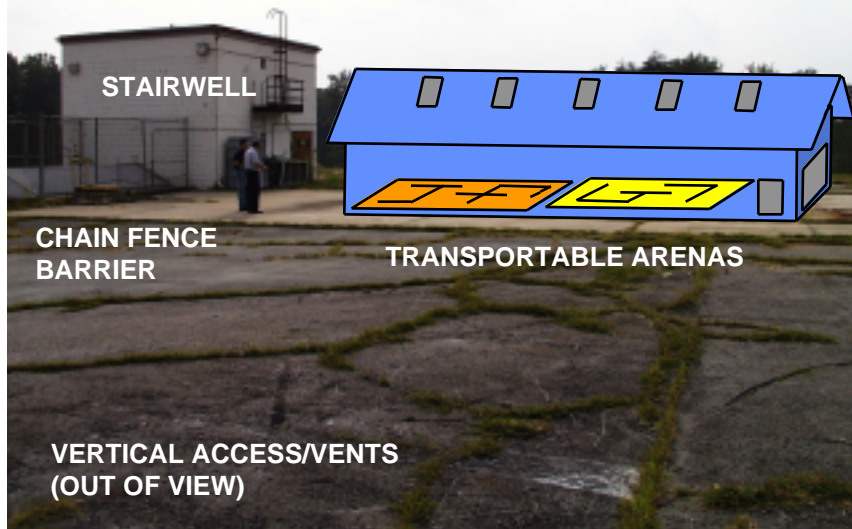
ROOF HATCH



UPPER STAIRS



LOWER STAIRS



STAIRWELL

CHAIN FENCE
BARRIER

TRANSPORTABLE ARENAS

VERTICAL ACCESS/VENTS
(OUT OF VIEW)



CONFINED ACCESS AREAS

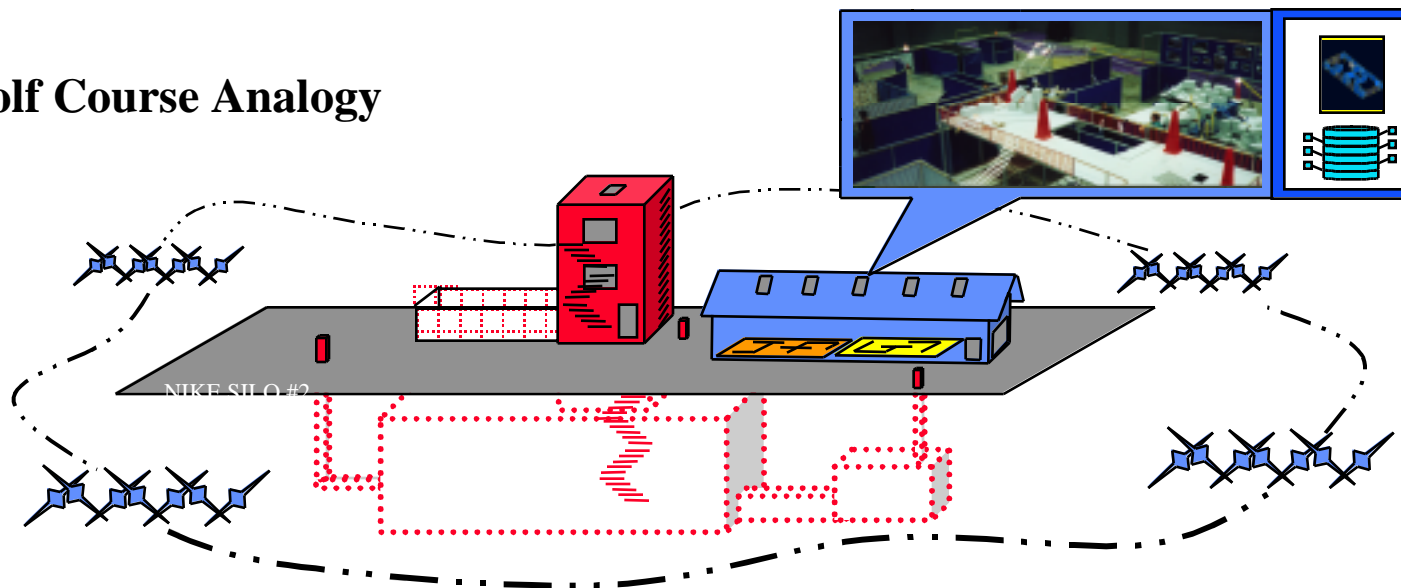


LARGE ROOMS/OBSTACLES

Reference Test Arenas for Mobile Robots

WHY, AGAIN, IS THIS NEEDED?

- *“Teaching to the Test”*
- *“Comparing Apples to Oranges”*
- *“Re-Creating the Wheel”*
- *“Practice, Practice, Practice”*
- Golf Course Analogy



IF WE BUILD IT... THEY WILL COME!